

## A closer look at the main actors of Neotropical floodplain food webs: functional classification and niche overlap of dominant benthic invertebrates in a floodplain lake of Paraná River

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**ABSTRACT.** Functional classification of animals is necessary to enhance the predictive power of food web models. However, while there is a large database for functional classification of benthic invertebrates (Functional Feeding Groups, FFG) in the temperate zone, the attribution of individual species of riverine invertebrates is still in its infancies in the Neotropical Region. Different authors hypothesized that diet breadth was larger in the Tropics, however detailed analyses are scarce. In the present study we aimed at classifying dominant benthic taxa of the Middle Paraná River floodplain (Argentina) into trophic guilds by diet and niche overlap analysis. We sampled twelve taxa of benthic invertebrates from a floodplain lake during low water season and performed a gut content analysis as a baseline for FFG classification. We also used available diet information of other common taxa for statistical analysis. Then, we compared the variance of niche overlap, using Pianka's index, with that of simulated null model. After that we grouped taxa using Morisita similarity index with a threshold of 0.6 and compared niche overlap with null models within and between FFGs. Observed variance of niche overlap was greater than expected by chance, confirming the presence of FFGs among analyzed taxa. Considering trophic similarity of species, we identified four FFGs: collectors, omnivores, herbivores and predators. Niche overlap was greater than expected by stochastic null models within FFGs, and smaller between FFGs. Nearly one third of analyzed taxa were classified in a different FFG than their congeners of the Holarctic region. This result indicates that classifications performed in the Holarctic region should be used with care in the Neotropical region, even in subtropical systems.

**KEYWORDS.** Diet, floodplain, null models, feeding habits, Paraná River.

Trophic interactions reveal important properties of ecosystems (ELTON, 1927; LINDEMAN, 1942; ODUM, 1957). However, it has been acknowledged that some empirical and theoretical problems hamper the construction of predictive models based on trophic information (WINEMILLER & LAYMAN, 2005). One of these problems is the attribution of food web components. While a typical ecosystem may contain hundreds (or even thousands) of species, constructing food web models with high levels of taxonomic resolution remains difficult (YODIS & WINEMILLER, 1999). In this context, grouping species using a similarity criterion for their feeding activity (instead of aggregating species in higher taxonomic groups as genus or family) is a sensible first step for any food web analysis (CUMMINS, 1973).

Functional classification of species into trophic groups has been based mainly on morpho-behavioral similarities in the food acquisition modes. This proved useful, and is widely used in freshwater ecosystems (CUMMINS, 1973; CUMMINS & KLUG, 1979; CUMMINS & MINSHALL, 1995; CUMMINS *et al.*,

2005). While related taxa (with similar mouth morphology) may present different feeding habits in different climatic zones (TOMANOVA *et al.*, 2006), the gut content analysis provides valuable information to allocate taxa into Functional Feeding Groups (FFG). Thus, taxa with similar resource use (or niche overlap) should be grouped, while those that presented different resource use (niche segregation) should be placed in different groups (PALMER *et al.*, 1993; JARDINE *et al.*, 2005). In recent decades, simulation algorithms have been developed to compare observed patterns of resource use with null models, thereby providing an objective quantitative criterion to assess niche overlap between species (GOTELLI & GRAVES, 1996).

Another shortcoming when constructing useful food web models is that most of the current ideas of trophic ecology have been developed in a limited latitudinal range (mainly North America and Europe). In this context, many authors have suggested a “tropical vs temperate” dichotomy, according to which these regions would differ

in their ecosystems functioning. In temperate rivers the litter breakdown is carried out by macroinvertebrates (shredders), but in higher temperature systems, this process is mainly driven by bacteria. As result of this, in warm regions shredders are relatively scarce while gatherer collectors are much more abundant. Besides, food web studies performed in temperate and tropical environments have shown differences regarding autotrophy and omnivory degree (MOULTON, 2006; DUDGEON *et al.*, 2010). Moreover, some detailed tropical-temperate comparisons (e.g. WANTZEN & WAGNER, 2006; TOMANOVA *et al.*, 2006) have shown that taxonomically related species may play different roles in temperate and tropical food webs.

However, very often data of large table works from the temperate zone such as MERRITT & CUMMINS (1996) have been used for classification in South America. Besides, most of the studies have been developed in first orders rivers, while functional feeding groups in floodplain systems are scarcely studied.

The Middle Paraná River is a subtropical large river placed in South America (in the Neotropical biogeographic region). On the one hand as this reach of the river is not a tropical system, it is possible that classifications performed in temperate regions could be applicable. However, while this system is a different biogeographic region, differences in the trophic role of species could also be expected. While the information about trophic habits of macroinvertebrates in this system is scarce (SAIGO *et al.*, 2009; GALIZZI *et al.*, 2012), it remains doubtful if species of this subtropical systems would play a different role than those of the temperate region.

Therefore, this study aimed: (1) To analyze the diet of dominant benthic taxa of the Middle Paraná River in a representative floodplain lake; (2) To allocate these taxa into FFGs according to trophic similarity and niche overlap patterns. Since litter breakdown in warm region is largely driven by bacteria and a great amount of fine detritus is available for invertebrates, we expected that species classified as shredders, predators, herbivorous or scrapers in Holarctic region, would be classified as gatherer collectors in the study site.

## MATERIAL AND METHODS

**Field and laboratory activities.** Sampling was carried out in an unnamed floodplain lake (31°40'36.7"S; 60°32'2.2"W) (near Paraná city) on August - November 2011, during the low water level season. This lake is characterized by two permanent connections with the main channel of the Paraná River and a secondary channel (Mini stream). This double connection implies a bidirectional exchange of benthic invertebrates between this lake and both rivers (MESA *et al.*, 2012). As a result, this is a representative floodplain lake of the Middle Paraná River. The area of this lake is 0.28 km<sup>2</sup> ha and its maximum depth is 8 m. For this study, we selected some of the most common taxa in the floodplain of the Middle Paraná River (summarized in MARCHESI *et al.*, 2002; Ezcurra de DRAGO *et al.*, 2007; ZILLI & MONTALTO, 2012) that were present in the lake during the

studied period. Thus, the invertebrates selected to perform the diet analysis were adults of *Dero vagus* Leidy, 1880, *Nais communis* (PIGUET, 1906), *Pristina leidy* Smith, 1896 and *Aulodrilus pigueti* Kowalewski, 1914 (Oligochaeta), late instars larvae of *Parachironomus* Lenz, 1921 and *Monopelopia* Fittkau, 1962 (Diptera, Chironomidae), late stages nymphs of *Campsurus violaceus* Needham & Murphy, 1924, *Americabaetis* Klunge, 1992 and *Caenis* Stephens, 1835 (Ephemeroptera), *Sympetrum* Newman, 1833 (Odonata: Libellulidae), *Cyrnellus* Banks, 1913 (Trichoptera, Polycentropodidae) and adults of *Pomacea canaliculata* Lamarck, 1828 (Mollusca, Gastropoda, Ampularidae). Specimens were deposited in Benthos collections of the Instituto Nacional de Limnología (Santa Fé, Argentina).

Benthic invertebrates (except *P. canaliculata*) were collected with Ekman grab of 225 cm<sup>2</sup> and were fixed in 10% formaldehyde in the field. Chironomids, oligochaetes and ephemeropterans were sampled in clay silt patches. *Cyrnellus* sp. and *Sympetrum* sp. were collected in patches of leaf litter. In laboratory, organisms were handpicked under stereoscopic microscope (4X) and preserved in 70% alcohol. *Pomacea canaliculata* (Gastropoda) individuals were handpicked in field and frozen at -18°C, and then the anterior gut was dissected for diet analysis. The consumers were identified to genus or species level using taxonomic keys (BRINKHURST & MARCHESI, 1991; DOMÍNGUEZ & FERNÁNDEZ, 2009; TRIVINHO-STRIXINO, 2011). Gut content of *Pomacea canaliculata*, *Sympetrum* sp. and *C. violaceus* were extracted and the proportional contribution of food items was quantified under the microscope (100X). Oligochaeta individuals were cleared with lactophenol, while chironomids, *Caenis* sp., *Americabaetis* sp. and *Cyrnellus* sp. were cleared with Hoyer, then squashed and analyzed directly from slides. We analyzed the whole gut content of all taxa, under the microscope (100X). The sets of slides were prepared from larvae collected from each sample (10-30 individuals). The proportion of each food item in the guts was estimated from the relative area of the particles in each slide (magnification at 100 X) using a microscopic ocular grid. Five categories of food resource were recognized: detritus (Det), vegetal tissues (Veg), filamentous algae (Algae), Bacilliarophyceae (Bacil), Chironomidae (Chir), Ostracoda (Ostr), Copepoda (Cop), Diptera (Dipt), Coleoptera (Col), Acari (Acar), Hyalella (Hyal), Cladocera (Clad) and not identifiable animal tissues (Anim). The importance of each item was measured according to the Index of Relative Importance (%IRI) (Cortés, 1998).

**Data analysis.** Additional diet information of other common taxa in the area such as *Hyalella curvispina* Shoemaker, 1942 (Amphipoda), the chironomids *Procladius* Skuse, 1889, *Ablabesmyia* Johannsen, 1905, *Pelomus* Reiss, 1989, *Cladopelma* Kieffer, 1921, *Chironomus* Meigen, 1803, *Endotribelos* Grodhaus, 1987 *Phaenopsectra* Kieffer, 1921 and *Polypedilum* Kieffer, 1912 were used from previous studies by SAIGO *et al.* (2009) and GALIZZI *et al.* (2012).

We analyzed the patterns of niche overlap in order to verify if analyzed taxa were structured into guilds. In that case, some taxa would present high niche overlap (those

belonging to the same guild) while others would show lower overlap (those of different guilds). Therefore, the observed variance in niche overlap would be greater than expected by stochastic processes (INGER & COLWELL, 1977; WINEMILLER & PIANKA, 1990). For that propose, we tested the niche overlap variance, using Pianka's index, against null models using the software EcoSim 7.0 (GOTELLI & ENTSMINGER, 2005).

After confirming the presence of guilds, we performed a cluster analysis using Morisita similarity index, considering a similarity threshold of 0.6 (WALLACE & RAMSEY, 1983) in order to define groups. Moreover, we applied a non metric multidimensional scaling (NMDS) using the same similarity index. Likewise, we compared niche overlap within and among guilds with simulated null models with EcoSim 7.0.

**Randomization algorithms.** Null models provide a quantitative basis to assess observed niche overlapping among species. To generate random matrices two decisions must be taken. First, niche breadth can be retained or relaxed. If niche breadth is retained the trophic specialization of taxa is preserved in simulated matrices. Second, zero states can be retained or reshuffled. If zeros are retained, resources that are not consumed by certain consumer are not consumed in simulated matrices either. Therefore, there might be four different scenarios, R1-R4. Randomization algorithm R1 relaxes niche breadth and reshuffles zeroes and tends to simulate "too null" matrixes. On the other hand, matrixes simulated with the algorithm R4, which retains both niche breadth and zeroes tend to be too conservative and subject to error type II. Therefore, recommended randomization algorithms are R2, which relaxes niche breadth and retains zeroes, and R3 which retains niche breadth and reshuffles

zeroes (GOTELLI & ENTSMINGER, 2005). In the present study, as we aimed at including observed niche breadth in the analysis, we used R2 as randomization algorithm.

This classification was then, compared to that performed in the Holarctic Region (CUMMINS & KLUG, 1974; MERRITT & CUMMINS, 1996).

## RESULTS

**Diet analysis.** Detritus was the most important feeding item for most of analyzed taxa. Except from *Monopelopia* sp., *Sympetrum* sp. and *Pomacea canaliculata* all the taxa presented detritus as their dominant food item. In some cases, indeed, its importance reached almost 100% of the relative importance (*Americabaetis* sp., *Caenis* sp., *Campsurus violaceus* and *Nais communis*) (Fig. 1).

*Sympetrum* sp. was the taxon for which animal tissues (*Hyalella*, Coleoptera, Diptera, Acari, Oligochaeta, Ostracoda, Cladocera and Copepoda) were the most important food item. On the other hand, *P. canaliculata* presented a great dominance of vegetal tissues in its diet, although detritus, algae and even animal tissues were registered as ingested items for this species. The chironomid *Monopelopia* sp. in turn presented a wide trophic spectrum including algae (Bacillariophyceae and filamentous algae), detritus, vegetal and animal tissues (Fig. 1).

These data were combined with those of SAIGO *et al.* (2009) and GALIZZI *et al.* (2012) to analyze patterns in niche overlap and trophic similarity. Niche overlap variance turned out to be greater than expected by chance ( $p < 0.05$ ) indicating that some taxa presented higher levels of niche

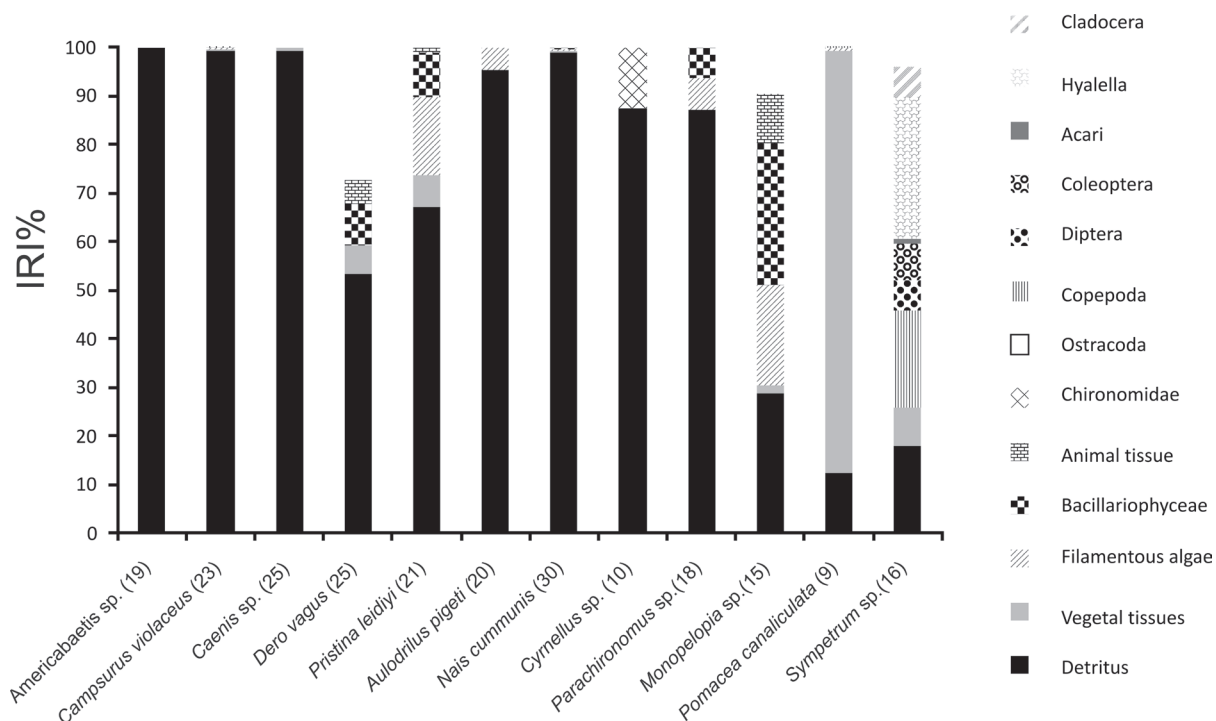


Fig. 1. Relative importance (IRI) of food items for analyzed taxa of dominant benthic invertebrates in a floodplain lake of Paraná River, Argentina (parenthesis indicate sample size).

overlap than others (Appendix 1). This result indicated that analyzed taxa were structured into guilds.

Cluster analysis using Morisita similarity index with a threshold of 0.6 yielded 5 groups (Fig. 2): one group included *A. pigueti*, *P. leidyi*, *D. vagus*, *N. communis*, *Parachironomus* sp., *Polypedilum* (*Tripodura*), *Chironomus* gr. *decorus*, *Cladopelma* sp., *Phaenopsectra* sp., *Endotribelos* sp., *Pelomus* sp., *Crynellus* sp., *Caenis* sp., *Americabaetis* sp., *C. violaceus* and *H. curvispina*. This group is characterized by a strong dominance of detritus as feeding item, thus it will be hereafter referred to as gatherer collectors.

*Coelotanypus* sp., *Procladius* sp., and *Ablabesmyia* (*Karelia*) built up a different group characterized by animal tissues (predators). Although *Sympetrum* was placed in a different group, its diet is also characterized by animal tissues (see discussion). The diet of *P. canaliculata* was characterized by vegetal tissues and therefore this species will be hereafter referred as herbivorous (see discussion). *Monopelopia* sp. in

turn, presented a wide trophic spectrum with even proportions of detritus algae and animal tissues, and then we considered this taxon as omnivorous. This classification was supported as well by the NMDS that yielded a consistent multidimensional ordination with a stress value of 0.02 (Fig. 3).

We performed an intra group overlap analysis only for those FFG that contained more than one species (gatherer collectors and predators). This analysis pointed out that niche overlap within gatherer collectors was higher than expected by chance ( $p=0.0001$ ). Likewise, niche overlap within predators was not significantly different than null simulations (the index obtained between *Coelotanypus* and *Procladius* was 0.90 and *Ablabesmyia* (*Karelia*), 0.99; while between *Procladius* and *Ablabesmyia* (*Karelia*) it was 0.84). On the other hand, niche overlap among groups was lower than expected by chance ( $p=0.017$ ).

Nearly one third of analyzed taxa (7 of 22) were classified in a different functional feeding group than in the

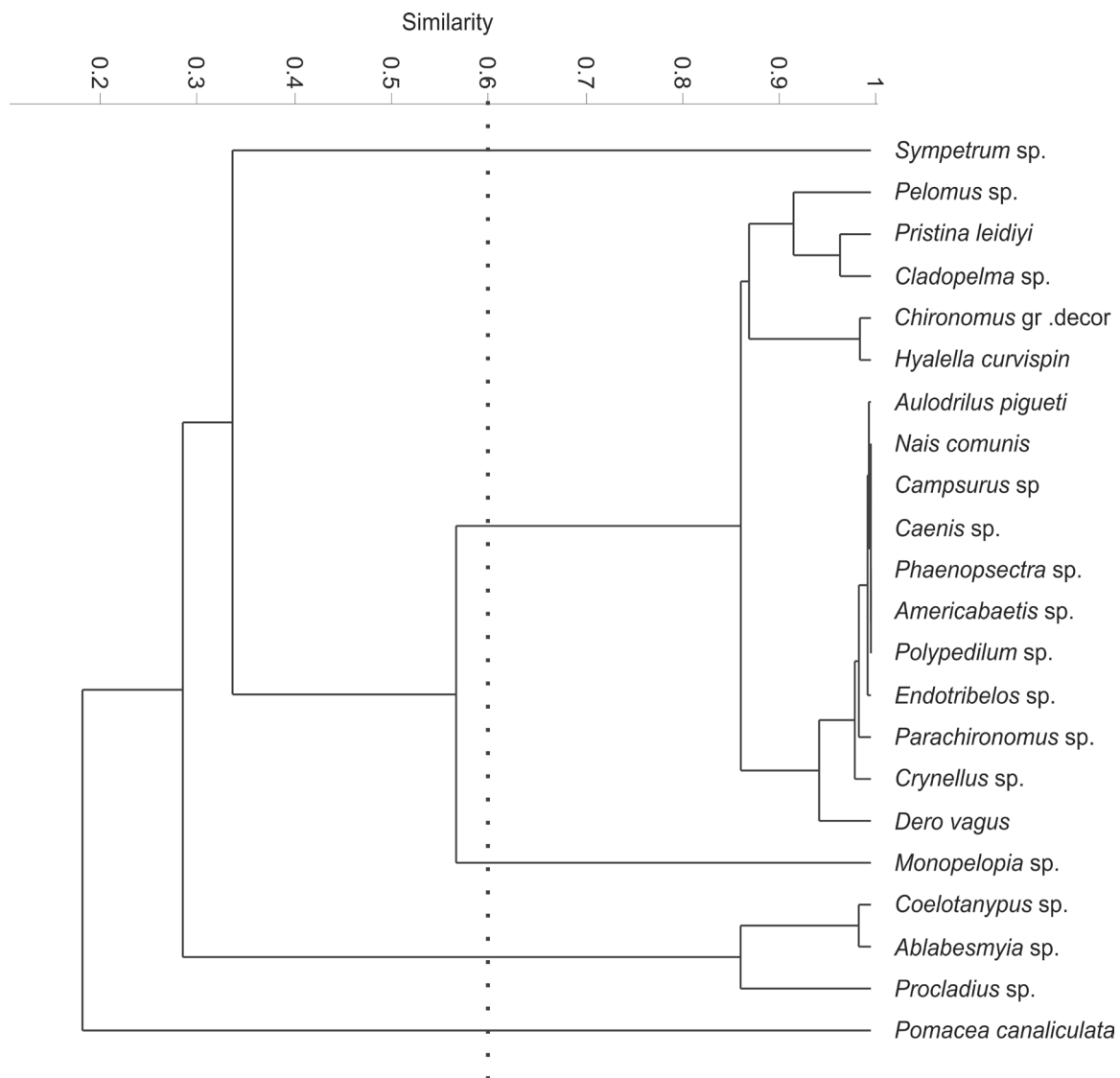


Fig. 2. Cluster plot depicting trophic similarity (Morisita index) among species of dominant benthic invertebrates in a floodplain lake of Paraná River, Argentina. Dotted line depicts the threshold similarity of 0.6.

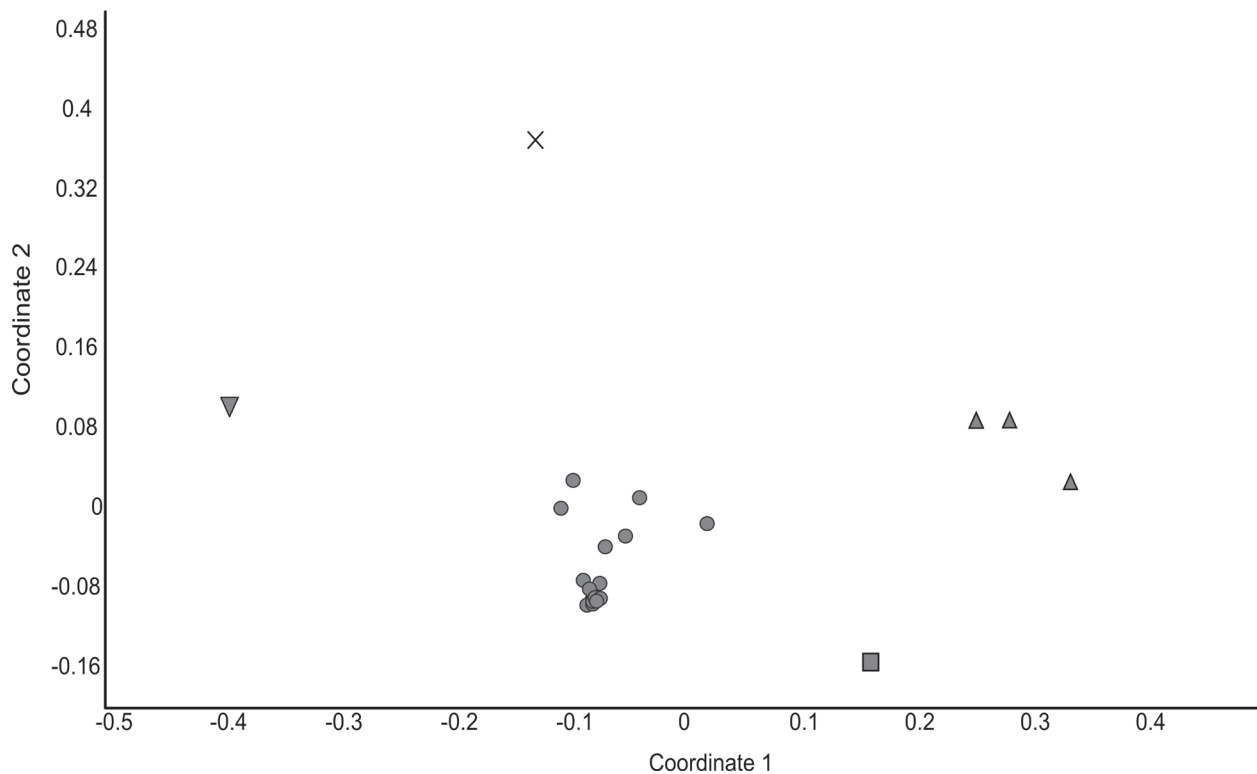


Fig. 3. Non Metric Multidimensional scaling plot. Circles depicts taxa classified as gatherer collectors (*Aulodrilus pigueti*, *Pristina leidyii*, *Dero vagus*, *Nais communis*, *Pelomus* sp., *Cladopelma* sp., *Endotribelos* sp., *Polypedilum* sp., *Chironomus* sp., *Parachironomus* sp., *Phaenopsectra* sp., *Americabaetis* sp., *Baetis* sp., *Campsurus violaceus*, *Hyaella curvispina*, *Cyrnellus* sp.) [Triangles: Tanypodinae (*Coelotanypus* sp., *Procladius* sp. and *Ablabesmyia* (Karelia)); inverted triangle: *Sympetrum* sp.; square: *Monopelopia* sp.; cross: *Pomacea canaliculata*].

Tab. I. Comparison between functional classification of taxa in the Holarctic region (according to MERRIT & CUMMINS, 1996; CUMMINS *et al.*, 2005) and the studied lake in the Neotropical region. Shaded rows refer to taxa which, in this study, were classified in a different functional feeding group than in the Holarctic region.

Taxa	Holarctic Region	Studied lake (Neotropical Region)
<i>Polypedilum</i>	Shredders (herbivores - Miners - collector gatherer (and filters?) predators (engulfers)	Gatherer collectors
<i>Pelomus</i>	Collector gatherer	Gatherer collectors
<i>Cladopelma</i>	Collector gatherer	Gatherer collectors
<i>Chironomus</i>	Collector gatherer (a few filterers), shredders herbivores (miners)	Gatherer collectors
<i>Phaenoptra</i>	Scrapers, collector gatherer (and filters?)	Gatherer collectors
<i>Endotribelos</i>	Shredders (herbivores -Miners and chewers- macroalgae, collectors	Gatherer collectors
<i>Parachironomus</i>	Predators - engulfers, collector gatherer, parasites	Gatherer collectors
<i>Pristina leidyii</i>	Gatherer collectors	Gatherer collectors
<i>Aulodrilus pigueti</i>	Gatherer collectors	Gatherer collectors
<i>Nais communis</i>	Gatherer collectors	Gatherer collectors
<i>Dero vagus</i>	Gatherer collectors	Gatherer collectors
<i>Monopelopia</i>	Predators (engulfers)	Generalist
<i>Coelotanypus</i>	Predators (engulfers)	Predator
<i>Ablabesmyia</i>	Predators (engulfers)	Predator
<i>Procladius</i>	Predators (engulfers)	Predator
<i>Campsurus</i>	Collector gatherers	Gatherer collectors
<i>Caenis</i>	Collectors gatherer, scrapers	Gatherer collectors
<i>Americabaetis</i>	Collector gatherer, scrapers (Baetis)	Gatherer collectors
<i>Cyrnellus</i>	Collector filterer	Gatherer collectors
<i>Hyaella</i>	Shredder (Gammarus)	Gatherer collectors
<i>Pomacea canaliculata</i>	Scrapers	Herbivorous, scraper
<i>Sympetrum</i>	Predators (engulfers)	Predator



Holarctic region (Tab. I).

## DISCUSSION

The present study provides a functional classification for some abundant benthic invertebrate taxa in a floodplain lake of the Middle Paraná River. Taxa such as *H. curvispina*, *Phaenopsectra* sp., *Endotribelos* sp., *Parachironomus* sp. and *Polypedilum* sp. were, in this study, classified as gatherer collectors although in the Holarctic region they are allocated in different FFGs. Indeed, most of analyzed taxa were classified as gatherer collectors with detritus as the most important feeding item. The great importance of the detritus energy pathway in the floodplain of the Middle Paraná River has been evidenced in previous studies (EZCURRA DE DRAGO *et al.*, 2007; MARCHESI *et al.*, 2014). Primary production of macrophytes in this system is very high, for example, the biomass fluctuated between 0.30 and 8.67 t dry weight ha<sup>-1</sup> (SABATTINI & LALLANA, 2007). This production and the high bacterial activity result in a great amount of fine detritus, which is food source for gatherer collectors. This would explain that certain taxa which in temperate regions were classified as shredders, in this study they (or taxonomically related taxa) were classified as gatherer collectors (i.e. *Polypedilum* sp., *Endotribelos* sp., *H. curvispina*).

However, some studies have suggested the concept of “snail shredder” for environments in which hard substrata is scarce and snails scrape on plants, accelerating their breakdown (MULHOLLAND *et al.*, 1985; RAMIREZ & GUTIERREZ-FONSECA, 2014). While our gut content analysis revealed that *P. canaliculata* feed on vegetal tissues, we allocated this species in the guild “herbivorous”. Moreover, in the context of a general scarcity of shredders in Neotropical streams and their replacement by large omnivores in floodplain rivers (WANTZEN & WAGNER, 2006), the great importance of vegetal tissues in the diet of *P. canaliculata*, suggests a role of this species in plant breakdown.

Likewise, comparative morphological studies have suggested that Tanypodinae were predators (GOUIN, 1959; BRYCE & HOBART, 1972). Although *Ablabesmyia* (*Karelia*), *Coelotanypus* sp. and *Procladius* sp. were confirmed to be predators by this study, *Monopelopia* sp. appears to be an exception. Indeed, this genus is classified as a predator in temperate regions but in this study we classified it as omnivorous. Some diet analysis concluded that, under certain conditions, species of Chironomidae may utilize a wider range of trophic resources (BAKER & McLACHLAN, 1979; MOTTA & UIEDA, 2004; GALIZZI *et al.*, 2012; SAITO & FONSECA-GESSNER, 2014; BUTAKKA *et al.* 2014). Our results pointed out that, because of its wide trophic spectrum, *Monopelopia* sp. may play different roles by predating, grazing algae or consuming detritus. Further efforts should be devoted in order to know the trophic selectivity and plasticity of this taxon.

*Sympetrum* sp. was identified as a predator, and *Hyaella* sp. was its most important prey followed by copepods (Cyclopoda) and Cladocera. Although vegetal tissues and detritus were found in the diet of this genus, probably these

items were in the stomach of digested prey organisms as suggested by WALKER (2009). However, some copepods and cladocerans can inhabit benthos and littoral plankton and their presence in the diet of *Sympetrum* sp. could suggest a role of this genus linking benthic and pelagic/planktonic food webs, as previous studies have reported predation of zooplankton by Odonata (TIMMS & MOSS, 1984; CORBET, 1999; BURKS *et al.*, 2001; GONZALES SAGRARIO *et al.*, 2009). Although animal tissues are the main feeding item for this taxon as well as for Tanypodinae (*Ablabesmyia*, *Procladius* and *Coelotanypus*), in the cluster analysis and the NMDS they were placed in different groups. We consider that the bigger size of the dragonfly larvae allows the ingestion of relatively big preys such as *Hyaella* sp. which are inaccessible for Tanypodinae larvae. In this context, Tanypodinae and *Sympetrum* may belong to different guilds (*sensu* RAMIREZ & GUTIERREZ-FONSECA, 2014) as they rely on different preys but, while they predate on other consumers, their FFG is Predators.

The present study provides a functional classification of common taxa in a floodplain lake of the Middle Paraná River based on gut content analysis. Nearly one third of analyzed taxa were classified in a different FFG than in the Holarctic region. This result indicates that classifications performed in the Holarctic region should be used with care in the Neotropical region, even in subtropical systems. Further efforts should be devoted to classify other common macroinvertebrate taxa of this system. As well, quantitative analysis should be performed to measure the relative importance of each FFG since even single species guilds, like herbivores, could be highly abundant and therefore crucial for system dynamics.

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## Appendix 1. Niche overlapping (Pianka index) among species.

	<i>Campsurus</i> sp.	<i>Caenis</i> sp.	<i>Dero vagus</i>	<i>Pristina leidyii</i>	<i>Aulodrilus pigueti</i>	<i>Nais comunis</i>	<i>Crynellus</i> sp.	<i>Parachironomus</i> sp.	<i>Monopelopia</i> sp.	<i>Pomacea canaliculata</i>	<i>Sympetrum</i> sp.	<i>Pelomus</i> sp.	<i>Cladopelma</i> sp.	<i>Coelotanypus</i> sp.	<i>Procladius</i> sp.	<i>Chironomus</i> sp.	<i>Endotribelos</i> sp.	<i>Ablabesmyia</i> sp.	<i>Phaenopsectra</i> sp.	<i>Polypedylum</i> sp.	<i>Hyalella curvispina</i>
<i>Americabaetis</i> sp.	0.99	0.99	0.98	0.96	0.99	0.99	0.99	0.99	0.61	0.13	0.42	0.87	0.91	0.27	0.17	0.91	0.99	0.33	1.00	1.00	0.87
<i>Campsurus</i> sp.		0.99	0.98	0.96	0.99	0.99	0.98	0.99	0.61	0.14	0.42	0.87	0.91	0.28	0.17	0.92	0.99	0.33	0.99	0.99	0.87
<i>Caenis</i> sp.			0.98	0.96	0.99	0.99	0.98	0.99	0.61	0.15	0.42	0.87	0.92	0.27	0.17	0.92	0.99	0.33	0.99	0.99	0.87
<i>Dero vagus</i>				0.97	0.98	0.98	0.96	0.98	0.72	0.24	0.43	0.88	0.93	0.26	0.24	0.94	0.98	0.41	0.97	0.98	0.91
<i>Pristina leidyii</i>					0.97	0.96	0.95	0.98	0.78	0.22	0.42	0.91	0.97	0.31	0.30	0.91	0.96	0.33	0.95	0.95	0.88
<i>Aulodrilus pigueti</i>						0.99	0.98	0.99	0.63	0.14	0.40	0.88	0.93	0.28	0.17	0.91	0.99	0.33	0.99	0.99	0.87
<i>Nais comunis</i>							0.99	0.99	0.61	0.14	0.42	0.87	0.91	0.27	0.17	0.92	0.99	0.33	0.99	0.99	0.87
<i>Crynellus</i> sp.								0.98	0.60	0.13	0.42	0.86	0.90	0.27	0.17	0.90	0.98	0.32	0.99	0.99	0.87
<i>Parachironomus</i> sp.									0.68	0.14	0.42	0.89	0.93	0.28	0.20	0.91	0.99	0.32	0.99	0.99	0.87
<i>Monopelopia</i> sp.										0.12	0.26	0.75	0.72	0.43	0.52	0.57	0.61	0.41	0.61	0.61	0.57
<i>Pomacea canaliculata</i>											0.24	0.12	0.38	0.04	0.03	0.51	0.20	0.05	0.13	0.14	0.59
<i>Sympetrum</i> sp.												0.37	0.43	0.12	0.07	0.46	0.43	0.14	0.42	0.42	0.46
<i>Pelomus</i> sp.													0.92	0.63	0.32	0.80	0.87	0.64	0.87	0.87	0.79
<i>Cladopelma</i> sp.														0.38	0.38	0.94	0.93	0.39	0.91	0.91	0.93
<i>Coelotanypus</i> sp.															0.9	0.25	0.27	0.98	0.27	0.27	0.30
<i>Procladius</i> sp.																0.15	0.16	0.84	0.17	0.17	0.21
<i>Chironomus</i> sp.																	0.94	0.30	0.91	0.91	0.99
<i>Endotribelos</i> sp.																		0.33	0.99	0.99	0.90
<i>Ablabesmyia</i> sp.																			0.33	0.33	0.35
<i>Phaenopsectra</i> sp.																				1.00	0.87
<i>Polypedylum</i> sp.																					0.87